Amendments to the Claims

1. (currently amended) A method of releasing the intracellular contents of at least one cell of a cell-containing fluid sample for analysis, said method comprising the steps of:

   a. providing a substrate having a microchannel structure which includes at least one microchannel therein;

   b. generating an electric field from a source of electric potential, said electric field being applied in a spatially defined region of said at least one microchannel, comprising a cell lysis region, and having sufficient strength to induce cell lysis; ~~and~~

   c. ~~positioning~~causing said cell-containing fluid sample to flow through said cell lysis region, exposing said at least one cell of said flowing fluid sample ~~in said cell lysis region~~to said electric field for a time sufficient to release said intracellular contents of said at least one cell into said fluid sample, thereby providing a volume of analyte in said at least one microchannel~~.~~; and analyzing said volume of analyte in said microchannel structure.

2. (cancelled)

3. (currently amended) The method according to claim ~~2~~1, including causing said cell-containing fluid sample

to flow ~~into~~through said cell lysis region under the influence of hydraulic pressure.

4. (currently amended) The method according to claim ~~2~~1, including causing said cell-containing fluid sample to flow ~~into~~through said cell lysis region under the influence of electrokinetically-induced pressure.

5. (currently amended) The method according to claim ~~2~~1, including causing said cell-containing fluid sample to flow ~~into~~through said cell lysis region under the influence of an electric potential.

6. (original) The method of claim 1 further including introduction of a chemical lysing agent into said cell lysis region.

7. (original) The method of claim 1, wherein the strength of the electric field applied in step b. is substantially constant over time.

8. (original) The method according to claim 7 further including the steps of detecting a change in conductivity caused by the passage of said at least one cell through said at least one microchannel, and activating said source of electric potential in response to said detected change in conductivity, thereby to produce a substantially constant electrical field.

9. (original) The method of claim 1, wherein the strength of the electric field applied in step b. varies over time.

10. (original) The method according to claim 9 further including the steps of detecting a change in conductivity caused by the passage of said at least one cell through said at least one microchannel, and activating said source of electric potential in response to said detected change in conductivity, thereby to produce a varying electrical field.

11. (original) The method according to claim 9, wherein said electric field applied in step b. is pulsed.

12. (original) The method according to claim 11 further including the steps of detecting a change in conductivity caused by the passage of said at least one cell through said at least one microchannel, and activating said source of electric potential in response to said detected change in conductivity, thereby to produce a pulsed electrical field.

13. (original) The method according to claim 12, additionally including the step of deactivating said source of electrical potential in response to a further change in said conductivity.

14. (original) The method according to claim 7, additionally including the steps of directing light at said at least one microchannel, detecting scattered light from said at least one cell in said at least one microchannel, and activating said source of electrical potential in response to said detected scattered light, thereby to produce a substantially

constant electric field.

15. (original) The method according to claim 9, additionally including the steps of directing light at said at least one microchannel, detecting scattered light from said at least one cell in said at least one microchannel, and activating said source of electrical potential in response to said detected scattered light, thereby to produce a varying electric field.

16. (original) The method according to claim 11, additionally including the steps of directing light at said at least one microchannel, detecting scattered light from said at least one cell in said at least one microchannel, and activating said source of electrical potential in response to said detected scattered light, thereby to produce a pulsed electric field.

17. (original) The method according to claim 16, additionally including the step of deactivating said source of electrical potential in response to an absence of scattered light.

18. (original) The method of claim 1, wherein the strength of the electric field applied in step b. is caused to vary by varying at least one cross-sectional dimension of the microchannel within said cell lysis region.

19. (currently amended) The method according to claim ~~2~~1,

additionally including the step of causing said fluid sample to flow ~~through and~~ beyond said cell lysis region and performing the analysis of ~~analyzing~~ said volume of analyte in said microchannel structure beyond said cell lysis region.

20. (original) The method according to claim 19, wherein said volume of analyte is analyzed by a technique selected from the group consisting of flow injection analysis, electrophoresis, chromatography, electrochromatography, micellar electrochromatography, hydrodynamic chromatography, molecular sieving, or a combination thereof, causing separation of said volume of analyte into discrete segments.

21. (original) The method according to claim 20 further comprising subjecting at least one discrete segment to further analysis.

22. (original) The method of claim 21, including the further step of electrospraying said at least one discrete segment for analysis by mass spectroscopy.

23. (currently amended) The method of claim ~~21~~1, wherein said electric field is oriented axially with the direction of flow of said cell-containing fluid sample.

24. (currently amended) The method of claim ~~21~~1, wherein said electric field is oriented perpendicularly to the direction of flow of said cell-containing fluid

sample.

25. (currently amended) A microfluidic system for transport and lysis of at least one cell of a cell-containing fluid sample, said system comprising a source of electric potential, ~~and~~ a solid substrate having at least one microchannel with a longitudinal axis and means for causing flow of a cell-containing fluid sample through said at least one microchannel, said microchannel having a first wall portion on one side of said axis, a second wall portion on another side of said axis and a cell lysis region between said first and second wall portions, a first and a second electrical contact positioned adjacent said first and second wall portions of said at least one microchannel, said first and second electrical contacts being spatially separated by said cell lysis region and being electrically isolated from one another, said first and second electrical contacts being connected to said source of electrical potential which is operative to apply an electric field to said flowing cell-containing fluid sample in said cell lysis region within the microchannel space between said first and second electrical contacts~~,~~ ~~and means for transporting said cell-containing fluid sample along said at least one microchannel~~.

26. (original) The microfluidic system according to claim 25, wherein said first and second wall portions are

on opposite sides of said longitudinal axis.

27. (original) The microfluidic system according to claim 25, wherein said transporting means comprises means to apply a superambient hydraulic force through said at least one microchannel upstream of said cell lysis region.

28. (original) The microfluidic system according to claim 25, wherein said transporting means comprises means to apply a subambient hydraulic force through said at least one microchannel downstream of said cell lysis region.

29. (original) A microfluidic system according to claim 25, wherein said first and second electrical contacts comprise areas extending longitudinally of said at least one microchannel, said areas being substantially coextensive in length with each other and with said cell lysis region.

30. (currently amended) A microfluidic system for transport and lysis of at least one cell of a cell-containing fluid sample and separation of the intracellular content of said at least one cell, said system comprising a solid substrate having at least one microchannel disposed therein and means for causing flow of a cell-containing fluid sample through said at least one microchannel, said microchannel having a cell transport segment and a separation segment having first and second end

portions, first and second electrical contacts adjacent said microchannel, intermediate said transport segment and said separation segment, and spatially separated from one another, the microchannel space between said electrical contacts defining a cell lysis region, said electrical contacts being connected to a source of electric potential to apply an electric field to said flowing cell-containing fluid sample in said cell lysis region; ~~means for flowing said cell-containing fluid sample through said at least one microchannel;~~ and means between said first and second separation segment end portions for effecting separation of said intracellular contents of said at least one cell.

31. (original) The microfluidic system according to claim 30, wherein the cross-sectional area of at least a portion of said at least one microchannel within said cell lysis region is different from the cross-sectional area of at least a portion of the remainder of said at least one microchannel.

32. (original) The microfluidic system according to claim 31, wherein the cross-sectional area of at least a portion of said at least one microchannel within said cell lysis region is constricted relative to said cross-sectional area of at least a portion of the remainder of said at least one microchannel.

33. (original) The microfluidic system according to claim

31, wherein the cross-sectional area of at least a portion of said at least one microchannel within said cell lysis region is expanded relative to said cross-sectional area of at least a portion of the remainder of said at least one microchannel.

34. (original) The microfluidic system according to claim 25 further comprising:

means for sensing the presence of cell in said microchannel; and

means responsive to said sensing means for triggering an operational event.

35. (original) The microfluidic system according to claim 34, wherein the operational event is selected from the group consisting of: application of a cell lysis electric field in said cell lysis region, recordation of a time mark to indicate the start of a separation process, adjustment of fluid flow to cell arrival frequency, or a combination thereof.

36. (original) The microfluidic system according to claim 34, wherein said sensing means comprises third and fourth electrical contacts positioned adjacent to said first and second wall portions upstream of said cell lysis region.

37. (original) The microfluidic system according to claim 34, wherein said sensing means comprises an optical probe.

38. (original) The microfluidic system according to claim 37 wherein said optical probe comprises:

a light source adapted for directing light into said microchannel; and

a light detector adapted for detecting light scattered by a cell in said microchannel.

39. (currently amended) A method of releasing and analyzing compounds from at least one particle of a particle-containing fluid sample, comprising the steps of:

a. providing a substrate having a microchannel structure which includes a first microchannel intersecting with a second microchannel at an intersection;

b. positioning a particle of a particle-containing fluid sample in said intersection, said particle containing at least one compound;

c. introducing a chemical lysing solution into said intersection through said second microchannel, whereby said at least one compound is released into the fluid sample, thereby providing a volume of analyte in said intersection;

d. causing said fluid sample containing said analyte to flow through and beyond said intersection; and then

e. analyzing said volume of analyte in said

first microchannel beyond said intersection.

40. (currently amended) The method according to claim ~~40~~39, wherein the particle is cell.

41. (currently amended) The method according to claim ~~40~~39, wherein the particle is a synthetic particle selected from the group consisting of liposomes, vesicles, beads, or a combination thereof.

42. (currently amended) The method according to claim ~~41~~39, wherein the particle is a solid that has the compound chemically bonded to the surface thereof.

43. (newly added) The method according to claim 1, wherein said cell-containing fluid samples flows at a pre-determined rate before and after passage through said cell lysis region.

44. (newly added) the method according to claim 1, wherein the cell-containing fluid sample exposed to said electric field comprises a single cell.